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BRIDGE GRAFTING OF FRUIT TREES.

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INTRODUCTION.

Numerous inquiries are received at the Department of Agriculture every spring in regard to the treatment of fruit trees, especially apple trees, that have been girdled or otherwise injured during the winter by mice and rabbits. While there are various ways in which slight injuries of this character may be treated, if any attention seems advisable, wounds which girdle or nearly girdle the trunk require more specific measures if the tree is to be saved. In such cases bridge grafting is the method of treatment commonly employed; in fact, it is about the only remedy that can be recommended.

A bridge graft is made by using scions or small limbs to connect the two portions of the bark of a stock which have been separated by an injury; in other words, the injured area is "bridged" by a scion or scions, the ends of which unite with the uninjured parts above and below the wound in such a manner that a connection between the tissues is established.

RANGE OF USEFULNESS OF BRIDGE GRAFTING.

Bridge grafting may be used successfully on almost any kind of fruit tree that admits of being readily propagated by grafting. In practice there is occasion to resort to it very much more frequently

with the apple than with any other fruit, but pear trees are often treated, at least in some sections. No reason is apparent why the method should not be successful on plums and cherries. Peaches graft less readily than the other trees mentioned, and there may be some question as to the usefulness of the method in the case of this fruit. Bridge grafting is seldom used on shade or other ornamental trees, but with some kinds it would probably prove successful in overcoming certain types of injuries.

The injuries which can be overcome or lessened by bridge grafting are always local in character and do not of themselves at the time they occur seriously affect the health and vigor of the tree either above or below the injured area. Such injuries are usually either mechanical or pathological in character.

(P12697HP)

FIG. 1.—The trunk of an apple tree as it passed through the winter, surrounded by grass and weeds. In the spring it was found to be girdled by mice below the surface of the ground.

MECHANICAL INJURIES.

Mechanical injuries which may be remedied by bridge grafting are usually inflicted in one of three ways: By animals that feed upon the bark and tender wood, by insects that burrow through the growing layer of bark and wood, or by implements used in the tillage of the orchard, usually the result of the carelessness of workmen.

The animals liable to do the most damage by girdling are the common meadow mouse, pine mouse, pocket gopher, and rabbit—the cottontail in the States east of the Great Plains and the jack rabbit westward from the range of the cottontail to the Pacific Ocean.

Most of the injury caused by these animals is done during the dormant period, when other plants on which they feed are scarce. Rabbits, however, occasionally gnaw young trees quite early in the fall, and mice, especially meadow mice, may work at almost any time under the shelter of vegetation that has been allowed to accumulate about the base of trees.

Mice and gophers work usually near the surface of the ground or snow, though sometimes the injury may extend for a short distance both above and below the surface. Some species of mice and also

gophers may eat the small roots as well as the bark. Young trees are more apt to be attacked than older ones, but trees of mature age are sometimes seriously injured by these animals.

Where the injury is below the ground it is likely to remain unnoticed until it is revealed in the spring by the evident weakness of the tree after growth starts. If an injury is not suspected until the season is well advanced, the tree may be too far gone to be saved by any method of treatment.

A case of underground injury by mice is illustrated in figure 1, showing an apple tree as it passed through the winter surrounded by grass and weeds, which proved in the spring to have been badly girdled by mice. Figure 2 shows the same tree as figure 1, with the soil removed, thus exposing the girdled area.

(P12992HP)

FIG. 2.—The tree shown in figure 1, with the soil removed and the girdled area exposed to view.

Rabbits feed mostly at night, and, although they work entirely above ground, may do considerable damage, sometimes to the extent of stripping practically all the bark from the body of a tree.

Borers are the only insects which are likely to girdle the body or trunk of a tree.

PATHOLOGICAL INJURIES.

Local injuries may be caused by various diseases, of which pear-blight is the most common. The trunks of pear trees are not infrequently completely girdled and killed by this disease. If taken in time, however, it may be possible to cut away the diseased bark, bridge the wounded area with grafts, and thus save the tree.

Relatively large areas of bark may also be killed by what is commonly called sun scald, as well as by other troubles that are pathological or physiological in their nature. The losses from such injuries may often be greatly reduced by resorting to the method of treatment here described.

DETAILED INSTRUCTIONS FOR BRIDGE GRAFTING.

The important steps in bridge grafting are shown in figure 3. In preparing the wound to receive the grafts the injured parts should be thoroughly cleansed, all dead tissue cut away, and, if possible, the cleansed surface should be sterilized by washing it with a solution of bichlorid of mercury, copper sulphate, or some other antiseptic. The irregular edges of the bark (fig. 3, *A*) at the upper and lower margins of the wound should be cut back evenly, as shown in figure 3, *B*.

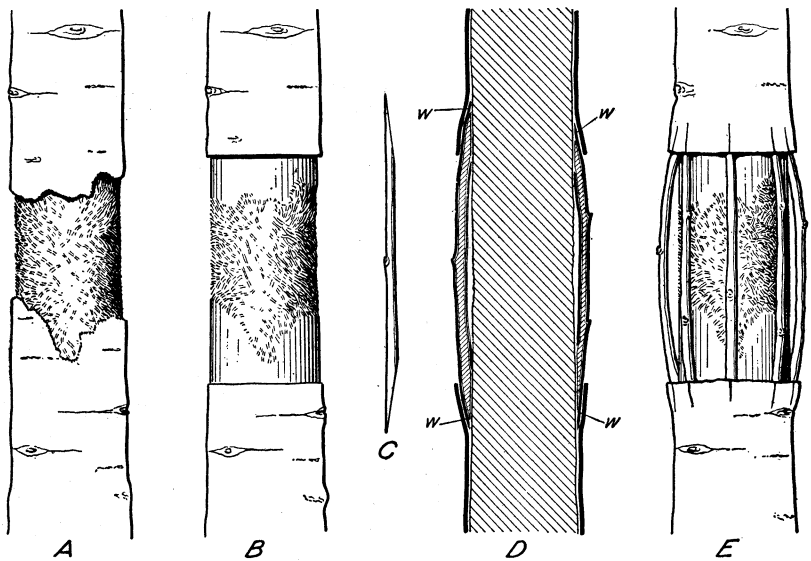


FIG. 3.—Details of bridge grafting: *A*, The trunk of a tree girdled by mice; *B*, the wound cleansed and the bark along the margins trimmed back to healthy, growing tissue; *C*, a scion with beveled ends ready for insertion; *D*, longitudinal section of the trunk with scions in place, showing their insertion under the bark of the trunk (*w*); *E*, scions in place ready for waxing.

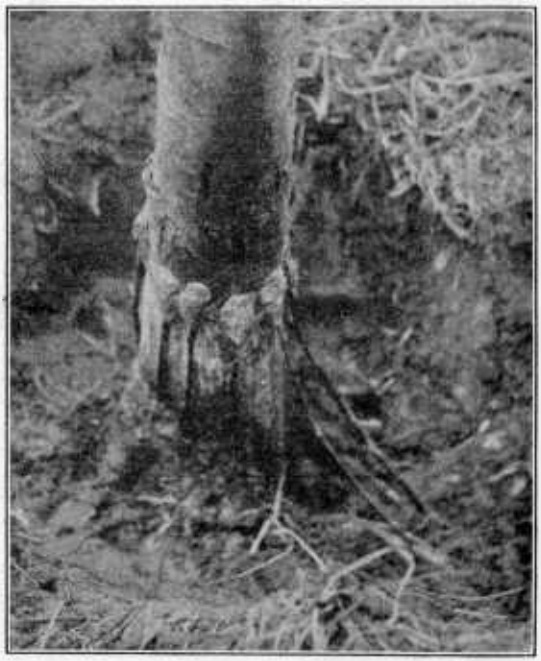
The scions which form the bridge should be selected from wood of the previous season's growth. Either branches which grew the preceding season or water sprouts that are only a year old may be used.

It is important that the scions should be a little longer than the space that is to be bridged. This is in order that the middle portion of the scions when put in position shall arch slightly over the central part of the wound. This is illustrated in figure 3, *D*, where a longitudinal section of a bridge graft is shown.

Before being placed in position the scions are beveled at each end, both beveled surfaces being on the same side of the scion, as shown in figure 3, *C*. This beveling should be done with a long, sloping cut, so that the wedge-shaped ends thus formed will be relatively thin, to permit their being thrust well under the bark without danger

of separating it unduly from the cambium at the points of insertion. Reference to figure 3, *D*, illustrates this feature. The placing of the scions in position is facilitated if the bark at the margins of the wound is slit for a short distance at the points where the ends are to be inserted. (Fig. 3, *E*.)

The number of scions required for a bridge will depend largely upon the size of the trunk. No fixed rule can be given. The larger the number, the more nearly complete will be the restoration of the connection between the parts above and below the wound; but if placed too close together, the bark at the margins of the wound between the scions will be raised. The starting of the bark except at the immediate points of insertion of the scions must be avoided.



(P12989HP)

FIG. 4.—The tree shown in figures 1 and 2, with the scions which form the bridge in place. As the injury extended some distance down a root on the right, relatively long scions were used on that side. Grafting wax has been applied to the ends of the scions and margins of the bark, to prevent drying out.

In placing the scions it is of the greatest importance that the cambium of the scions which is exposed in the sloping cuts at the ends be brought into intimate contact with the cambium that lies under the bark at the margins of the wounded area. The union of scion and tree can occur only where the cambium layers of the two come together. The scions may be secured in their proper positions, if need be, by driving a small nail through each end into the trunk. This will aid in drawing the cambium of scion and trunk closely together.

The operation is completed by thoroughly covering the area occupied by the ends of the scions and the margins of the wound with grafting wax, strips of waxed cloth, or by some other means that will adequately prevent these parts from drying out. The use of wax for this purpose is illustrated in figure 4. Some operators cover the entire wound, scions and all, with melted wax.

If the wound is mostly below the surface of the ground, as shown in figures 1 and 2, very good results can be obtained by burying the injured parts in a mound of earth after the bridge grafting has been completed, as shown in figure 5. This treatment partially excludes the air and aids in preventing undue drying out of the injured parts.

A bridge graft 3 years old, made to save a pear tree girdled by blight, is shown in figure 6. The diseased tissue was cut away before the bridging was done.

Another method of bridging a badly wounded area is suggested in figure 7, which shows a pear tree girdled by blight. The diseased bark and cambium have been cut away, thus making a wound so large that ordinary bridge grafting is impracticable. Several 2-year-old pear trees have been planted about the base of the injured tree, and their tops grafted into its trunk above the girdled space. As the tops of the small trees are too large to manipulate readily in the manner described for scions, V-shaped vertical grooves extending through the cambium are cut just above the wounded area in the bark of the tree to be treated. The tops of the small trees are shaped to correspond with these grooves. The two are then accurately fitted together in such a manner as to bring the cambium of one into contact with that of the other. Small nails may be driven through the tops of the trees into the trunk, to hold the parts firmly together. The wounds incident to joining the tops of the small trees to the trunk of the large one should be well covered with wax, to prevent drying out. In the case illustrated in figure 7 a cord has been tied around the trunk, to aid in holding the tops of the young trees in proper position.

(P12689HP)

FIG. 5.—The bridge graft shown in figures 1, 2, and 4 completed and entirely covered with earth.

This method has been employed with success for several years in at least one important pear-growing district of the Northwest, and

it is referred to in this connection because of its possible value in other sections.

To be effective, bridge grafting should be done in the spring before growth starts, though sometimes it can be done after growth starts if dormant scions for that purpose can be secured.

(P11212HP)

FIG. 6.—A bridge graft 3 years old, made to save a pear tree that had been girdled by blight. The diseased parts were cut away before the bridging was done.

PREVENTION OF INJURIES.

While the bridging of a wound by grafting is comparatively easy the use of preventive measures, so far as they are effective, is much easier. Weeds and rubbish about the trunk of a tree are likely to attract mice, as they furnish both a desirable nesting place and a food supply. By clearing away upon the approach of cold weather the grass and aftergrowth that has accumulated near the trees, the danger of injury from mice is greatly reduced.

(P11262HP)

FIG. 7.—A pear tree badly girdled by blight. Several 2-year-old pear trees have been planted about the base of the injured tree and their tops grafted into the trunk of the older tree.

Wherever rabbits are likely to gnaw the bark from young trees—and they work, as a rule, only in comparatively young orchards—adequate protection may be afforded by placing wire netting or wooden-veneer protectors about the trunks, or even by wrapping them with several thicknesses of newspaper. The latter

method is practicable where the number of trees is limited. A more convenient way, however, and one reported to be effective, is to keep the trunks well covered during the winter with a lime-sulphur mixture.

If trees are carefully examined two or three times each season for borers and proper measures are adopted for destroying them, serious losses from such insects may usually be prevented.

Further information in regard to the control of the animals and insects which are likely to girdle trees may be found in the publications listed below.

PUBLICATIONS OF THE DEPARTMENT OF AGRICULTURE RELATING TO ANIMALS AND INSECTS THAT ARE LIKELY TO GIRDLE TREES.

AVAILABLE FOR FREE DISTRIBUTION.

Field Mice as Farm and Orchard Pests. Farmers' Bulletin 670.
The Roundheaded Apple-Tree Borer. Farmers' Bulletin 675.

FOR SALE BY THE SUPERINTENDENT OF DOCUMENTS.

The Peach-Tree Borer. Entomology Circular 54. Price, 5 cents.
The Rabbit as a Farm and Orchard Pest. Separate 452, Yearbook, 1907. Price, 5 cents.
Pocket Gophers as Enemies of Trees. Separate 506, Yearbook, 1909. Price, 5 cents.

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